Lower Duwamish Waterway
Basin Oil
Seattle, Washington

Basin Oil Sampling

Sampling and Analysis Plan

DRAFT

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program
3190 - 160th Ave. SE
Bellevue, WA 98008-5452

Prepared by

Science Applications International Corporation
18912 North Creek Parkway, Suite 101
Bothell, WA 98011
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List of Acronyms

CFR	Code of Federal Regulations
COC	chain of custody
EAA	Early Action Area
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
FSP	Field Sampling Plan
HCID	hydrocarbon identification
LDW	Lower Duwamish Waterway
NAPL	non-aqueous phase liquid
PCB	polychlorinated biphenyl
PID	photoionization detector
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SCAP	Source Control Action Plan
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbons
USC	Unified Soil Classification

1.0 Introduction

This sampling and analysis plan (SAP) was prepared by Science Applications International Corporation (SAIC) on behalf of the Washington State Department of Ecology (Ecology). The SAP details environmental investigation activities to be carried out at the Basin Oil property. The SAP is composed of the Field Sampling Plan (FSP, Section 2.0) and the Quality Assurance Project Plan (QAPP, Section 3.0).

Basin Oil is located at 8661 Dallas Avenue South in South Park, a small community in the southern part of Seattle, Washington. The Basin Oil property is triangular shaped and bounded on the east by Dallas Avenue South; 17th Avenue South to the west; and Donovan Street to the south. Port of Seattle Terminal 117 is east of Dallas Avenue South (Figure 1). Historical information and sampling results suggest that soil and groundwater contamination may be present at the Basin Oil site.

SAIC conducted a file review of Basin Oil for the Terminal 117 Source Control Action plan (SCAP). The SCAP and property review describe the history and operations of Basin Oil in more detail. The nature and extent of any contamination remaining on the Basin Oil property has not been fully characterized. Because of its past use, and adjacent site soil and groundwater data, Basin Oil is a potential source of recontamination to Terminal 117 and the adjacent streets. In April of 2009, SAIC submitted a Work Plan detailing the work assignments of this investigation. This Sampling and Analysis Plan (SAP) was prepared based on the Work Plan.

The activities outlined in this SAP are intended to complete the conformational soil and groundwater sampling tasks and provide data on the nature and extent of contamination onsite. Investigation activities will include sampling and analysis of surface soil, subsurface soil, and groundwater.

2.0 Site Investigation Activities

Proposed investigation activities are summarized in the subsections that follow. Investigation activities will include soil borings, installation of monitoring wells, and collection and analysis of soil and groundwater.

2.1 Pre-Investigation Activities

The following activities will be performed prior to the start of field investigation activities:

- A site walk will be performed with the Washington State Department of Ecology (Ecology) representative, SAIC representative, and representatives of the property owners in order to assess to specific locations, to finalize boring locations, and to discuss schedule and interaction with tenants.

- Boring locations will be cleared for underground utilities using a private utility-locating firm as well as the state "one-call" system.

- The first 5 feet at each boring will be cleared using a hand auger to minimize potential damage to any undetected underground utility or other structures. This hand-clearing will be performed prior to drilling activities.

2.2 Soil Borings and Subsurface Soil Sample Collection

Soil samples will be collected using one of the following three methods: split-spoon sampler, portable geoprobe, or hand auger. Locations above 5 feet below ground surface (bgs), where the surface soil is dense and compacted or where asphalt is present, the surface material will first be removed with a shovel, rail iron, or other hand tool.

All borings will be geologically logged and the following items will be noted:

- Color
- Moisture content (dry, damp, moist, or wet)
- Lithology (using the modified Unified Soil Classification [USC] system)
- Geological interpretation, if possible (e.g., fill, topsoil, alluvium, till, etc.)
- Presence of sheen or non-aqueous phase liquid (NAPL)
- Presence of contaminant odor
- Field screening results for organic vapor (using photoionization detector [PID] or flame ionization detector [FID])
- Other indications of contamination (e.g., discoloration)

Determination of which samples are to undergo analytical testing will be based on predetermined intervals of interest. Additional samples maybe selected based on field screening of odor, PID measurement, discoloration, and sheen. Samples collected from both the hand augers and the geoprobe will be screened using field indications of contamination. Offsite soil samples will be analyzed for the parameters listed in Table 1, soil samples collected onsite will be analyzed for the parameters listed in Table 2.

All downhole tools, including the hand auger, will be decontaminated between samples using a non-phosphate detergent solution and a distilled-water rinse.

2.2.1 Offsite Soil Borings

Two surface samples will collected and submitted for laboratory analysis at intervals of 0-2 inches and 2-6 inches. Two offsite borings, which will be completed as groundwater monitoring wells, are proposed upgradient of the site. Soil samples collected from these two borings will be submitted for laboratory analysis at intervals of 0-6 inches bgs and 2.5 feet bgs. Additional soil samples will be collected from these two borings at 2.5 foot intervals extending from 5 feet bgs to the final depth of the borings approximately 25 to 30 feet bgs. These samples will be submitted to the laboratory and archived.

2.2.2 On site Geoprobe Borings

Ten geoprobe borings are anticipated to be installed on the Basin Oil property. These samples will be collected with a geoprobe unit. Where space allows, the geoprobe unit will be mounted to the Bobcat vehicle, providing extra weight and pulldown pressure. For tighter locations, the geoprobe unit can be removed from the bobcat and hand-wheeled up to approximately 100 feet. For locations where it is not accessible by the geoprobe rig, hand augers will be used. Soil samples will be collected at the surface and at a 2.5-foot interval continuing to the final depth of the boring approximately 15 feet bgs. For locations previously excavated, the final depth will be adjusted based on field observations indicating final depth of each boring are at approximately the same elevation.

2.3 Monitoring Well Installation and Development

A total of two monitoring wells will be installed upgradient from the site, directly west and south of the Basin Oil property. The anticipated locations of these wells are shown on Figure 1. The exact location of wells that are installed may be adjusted during the investigation to accommodate access requirements, utilities, or refusal conditions.

Monitoring wells will be installed using a limited access hollow-stem auger and will consist of 2-inch, flush-thread PVC risers and 10-ft long screens. Well screens will be set so that the water table intersects the well screen during all stages of the tide cycle. Borings will be sealed from the top of the sand pack to the ground surface with cement/bentonite grout. Wells will be completed with flush-mount vaults and equipped with watertight locking plugs. The new monitoring wells will be developed by surging the well with a steel bailer or surge block and then over-pumping with an electric down-well pump. Disposable discharge tubing will be used at each well. All well materials (screen, riser, etc.) will be delivered from the manufacturer pre-cleaned and sealed.

2.4 Surveying and Gradient Determination

The top-of-casing elevations of all new monitoring wells will be surveyed by a professional land surveyor. Elevations will be determined to the nearest 0.01 ft relative to North American Vertical Datum, 1988 (NAVD 88) so that the water table elevation can be readily compared with tidal elevation in the adjacent waterway.

2.5 Groundwater Sampling

One round of groundwater sampling of the two wells will be conducted as part of this investigation; subsequent rounds may be collected later depending on initial results. Groundwater sampling will be conducted within one hour period of the lower low tide using low-flow techniques with a peristaltic pump and disposable Teflon tubing. Wells will be purged at a low flow rate until field measurements of pH, conductivity, temperature, and turbidity stabilize. Groundwater samples will be analyzed for the parameters listed on Table 1. Water levels will be measured in each well prior to purging.

For metals, both filtered and non-filtered samples will be collected. This is in order to compare water samples without solids to those potentially containing solids (due to turbidity in the water sample). Filtered metals samples will be collected in the field using disposable, in-line, 0.45-micron nitrocellulose filters.

All non-disposable sample-contact equipment will be decontaminated between stations using a Liquinox™ detergent solution and a distilled water rinse.

2.6 Investigation-Derived Waste Management

The following investigation-derived waste will be containerized during this investigation: waste soil and decontamination water from the drilling and geoprobe activities and development water and purge water from the monitoring wells. This soil and water will be contained in 55-gallon U.S. Department of Transportation-approved drums, which will be left on site for temporary storage. Drums will be properly labeled and the appropriate placards affixed, with a generator contact name and phone number. Following receipt of laboratory analytical data, SAIC will arrange for disposal of this material. Transport and disposal of waste soil and water will be by Clean Harbors of Seattle, Washington. SAIC will coordinate transportation and disposal of this waste; Ecology is the generator and will sign all manifests, bill of lading, profile sheets, and any other shipping documents.

3.0 Quality Assurance/Quality Control Procedures

Section 3.0 constitutes the Quality Assurance Project Plan (QAPP) for this investigation. Supplemental and background information for this QAPP is found in Section 1.0 of this document and in the Work Plan. The primary objective of the QAPP is to assure that a sufficient number of samples are collected to gain quality analytical information to conduct sampling at the Basin Oil site, in order to evaluate the various environmental media of concern, and to determine whether a risk may occur of recontamination of the river.

3.1 Personnel

The site manager for Ecology is Dan Cargill, who is responsible for defining the scope and objectives of this project.

The SAIC project manager for this project is Glen Vedera, who is responsible for assuring that all personnel are trained to properly carry out this SAP (FSP and QAPP) and that all resources are made available to meet the investigation objectives.

The SAIC field manager is Gabriel Cisneros, who will implement this SAP, and will verify that samples and data are collected properly according to this SAP and all pertinent SAIC guidance (see Section 3.2). The field manager is also responsible for interacting with the analytical laboratory to assure that all laboratory objectives are met, and for notifying the project manager of any required field or analytical variances.

The SAIC field assistant is Julie Wartes, who will assist the field manager in proper collection of samples and data.

The SAIC database manager is Ruth Otteman, who is responsible for proper database storage and uploading of field and analytical information into Ecology's database.

3.2 Documentation

In performing field activities, SAIC follows a set of standard operating procedures (SOPs). The SAIC SOPs that will be used in this investigation include the following:

- EC&HS 130 Subsurface Asset and Hazard Avoidance
- FTP-400 Equipment Decontamination
- FTP-405 Cleaning and Decon of Sample Containers and Sampling Equipment
- FTP-625 Chain of Custody (COC)
- FTP-650 Labeling, Packaging, and Shipping of Environmental Field Samples
- FTP-1215 Field Logbooks and Field Forms
- FTP-1220 Documenting and Controlling Field Changes to Approved Work Plans
- QAAP 12.1 Control of Measuring and Test Equipment
- QAAP 15.1 Control of Nonconforming Items and Services

- QAAP 17.1 Records Management
- QAAP 2.3 Project Kickoff Checklist
- QAAP 3.1 Document Review
- QAO Quality Assurance (QA) Orientation
- SAIC EC&HS 13 Personal Protective Equipment
- SAIC EC&HS 20 Hazardous Waste Operations
- SAIC EC&HS 25 Management of Investigation-Derived Waste
- TP-DM-300-06 Data Package Receipt and Verification
- TP-DM-300-10 Analytical Laboratory Interface
- TP-DM-300-12 Handling and Control of Sampling Documentation
- TP-DM-300-13 Tracking Analytical Data

A complete record of field activities will be maintained. Documentation necessary to meet quality assurance (QA) objectives for this project includes field notes and field forms including: borehole logs, sample container labels, and chain-of-custody (COC) forms. The field documentation will provide descriptions of all sampling activities, sampling personnel, and weather conditions. All modifications, decisions, and/or corrective actions to the study design and procedures identified in this SAP will be recorded in the field documents with a signature and date.

Daily activities will be recorded in a bound field logbook of water-resistant paper. All entries will be made legibly, in indelible ink, and will be signed and dated. Information recorded will include the following:

- Date, time, place, and location of sampling
- Onsite personnel and visitors
- Daily safety discussion and any safety issues
- Quality control samples (i.e., duplicate samples, field blanks, etc.)
- Field measurements and their units
- Observations about site, location, and samples (weather, current, odors, appearance, etc.)
- Equipment decontamination verification

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during project field activities. Entries should be factual, detailed, and objective. Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification tags, COC records, and field forms will be written in waterproof ink. If an error is made, the individual responsible may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. All corrections must be initialed and dated. All documentation, including voided entries, must be maintained within project files. Photocopies or electronic scans of the field logbooks will be made at the end of each field event and maintained in the project file.

Boring logs will be used to record geological and well installation observations and data. Soil sampling information (sample ID, depth, time) will also be recorded on these logs. One boring log will be completed for each monitoring well and soil boring/probe.

Sample collection data sheets will be completed for each sample collected (aside from soil boring samples). Sample data sheets will contain date and time of sample collection, sample

number, station location and depth, field measurements (e.g., pH, conductivity, temperature), and analyses collected.

Sample labels will be attached to each sample container collected. Labels will contain the sample number, date and time of sample collection, analyses requested, and information on sample preservatives.

Chain-of-custody forms will accompany all samples shipped to the analytical laboratory. In addition to containing a record of sample information, chain-of-custody forms will contain the signature of the sample shipper and will document the date and time that samples were shipped. Upon receipt at the laboratory, the chain-of-custody record will be compared with the samples received, any discrepancies will be noted, and the form will be signed and dated by an authorized laboratory representative and a copy returned to the sender.

3.3 Analytical Methods

Table 1 lists the specific methods that will be used to analyze the samples offsite; Table 2 summarizes the specific methods that will be used to analyze the samples onsite; Table 3 summarizes number of samples expected to be collected and the analytical methods for each environmental media; and Table 4 summarizes the number of sample locations, estimated number of samples, analysis for each location and type of sample jars.

Analyses of soil and water will be performed by Analytical Resources, Inc. (ARI) located in Tukwila, Washington. The ARI laboratory is accredited by Ecology to perform the required analytical methods.

Samples will be transported to the laboratory in coolers on ice under chain-of-custody and extracted and analyzed within required holding times.

3.4 Laboratory QA/QC and Submittals

Laboratory quality control (QC) samples will include the following, as relevant to each analytical method:

- Method blanks
- Method blank spikes
- Laboratory control samples
- Surrogates
- Matrix spikes/matrix spike duplicates

Laboratory data will be provided electronically and in hard copy to SAIC and will consist of "Tier III" deliverables including project narratives, chain-of-custody documentation, data reports including method blank results, and QA summary forms. Deliverables will also include electronic data deliverables (EDDs) formatted to meet the submittal requirements of Ecology's Environmental Information Management (EIM) database. Third-party data validation will be performed by EcoChem, Inc. of Seattle, Washington.

3.5 Field QA/QC Measures

Samples will be considered acceptable to the field manager if sufficient quantity of material is recovered to adequately and appropriately represent the target material and depth interval. Examples of unacceptable samples or sample locations include split spoon or geoprobe cores with less than 50 percent in-situ soil recovery, soil samples with largely coarse-grained material (coarser than sand), refusal before extending below major contaminant depths, and water samples that are extremely turbid. For cases of poor recovery or refusal or lack of physical access, the SAIC field manager or project manager will discuss with the Ecology site manager to decide whether data completeness has been affected significantly enough to require moving boring locations or resampling.

Field QC samples will also be collected to gauge the quality of samples being collected; these include the following:

Field duplicates will be collected to assess natural variability in the sampled water matrix. Field duplicates will be collected at a rate of approximately 5 percent (one field duplicate for every 20 environmental water samples), with a minimum of one field duplicate collected per analysis per medium sampled. These samples will allow the relative percent difference to be calculated, to gauge the variability in the sampling and analysis processes. However, because soil contamination tends to be heterogeneous, and is not mixed and split during sampling, it is not anticipated that field duplicates will not be collected on soil samples. This will be a field decision based on the number and intensity of contaminated areas encountered.

Equipment rinses will be collected to assess the effectiveness of equipment decontamination and to confirm that no significant sample cross-contamination is occurring. Equipment rinses will be collected at a rate of one per sampling method where decontaminated sampling equipment is being used. This will apply to the hand auger and the drive shoe of the geoprobe unit. Equipment rinses will be prepared by running deionized water through (or pouring it over) all parts of the decontaminated sampling equipment that contact the sample. These rinse samples will be analyzed only for the primary contaminant of concern, polychlorinated biphenyls (PCBs).

Trip blanks will be submitted with every sample shipment in which samples are being analyzed for volatile organics (NWTPH-Gx). One trip blank, consisting of laboratory-supplied organic-free water, will be included in each cooler and analyzed upon receipt for the same constituents as the environmental samples.

3.6 Containers, Preservatives, and Holding Times

Table 3 summarizes the requirements for sample containers and preservatives as well as the maximum time that samples can be held after sampling and prior to being analyzed.

3.7 Sample Numbering

Samples will be designated as follows:

Surface soils: *SS-xx-yy* (for example, SS-01-0-6)
Where "xx" is the surface sample number (padded with a preceding zero for surface sample numbers less than 10), and "y-y" is the range in depth, in inches bgs.

Offsite subsurface soils (Completed as groundwater wells): *MW-xx-yy* (for example, MW-12-5)
Where "xx"is the boring number (padded with a preceding zero for well numbers less than 10), and "yy" is the depth, in feet bgs, of the top of the sampled interval.

Onsite subsurface soils: *BSB-xx-yy* (for example, BSB-01-05)
Where "xx"is the boring number (padded with a preceding zero for borings numbers less than 10), and "yy" is the depth, in feet bgs, of the top of the sampled interval.

Groundwater: *MW-xx-mmddyy* (for example, MW-12-051809)
Where "xx" is the boring number (padded with a preceding zero for well numbers less than 10), and "mmddyy" is the date.

Field duplicates: *sample number-FD* (for example, MW-12-051809-FD)
Where "sample number" is the sample designation of the duplicated sample, groundwater only.

Equipment rinses: *ER-mmddyy-x* (for example, ER-051809-1)
Trip blanks: *TB-mmddyy-x (for example, TB-0521809-2)*
Where "mmddyy" is the date and "x" is the sequential number of this type of sample prepared on the same day.

3.8 Field Equipment Calibration

Field instruments, including PIDs and water parameter meters, will be calibrated prior to use each day according to the manufacturer's recommended procedure using the appropriate calibration standards. Recalibration may be needed during the day after a significant gap of time, or if the instrument does not give reliable readings (such as does not zero out). All calibration of such instruments will be recorded in the field log book.

3.9 Sample Storage and Delivery Procedures

All samples will be stored in insulated coolers and preserved by cooling with ice or frozen gel-packs to a temperature of 4ºC. Maximum sample holding and extraction times will be strictly adhered to by field personnel and the analytical and testing laboratories. Samples will be delivered to the ARI by an SAIC representative. If samples are required to be shipped, preparation of bottles for shipment will be performed in the following manner:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 Code of Federal Regulations (CFR) 173.6 and 49 CFR 173.24.

- Place sample containers in plastic Ziploc bubble-pack bags, or wrap in bubble pack and secure with packaging tape.

- Prepare an empty insulated cooler by placing three to four ice packs in a garbage bag at the bottom of the cooler. Place sample containers in a garbage bag and fill with the sample bottles. Add additional bags of ice as needed to surround the bag containing the samples.

- COC forms will be enclosed in a plastic bag and placed inside the top of the cooler.

- Seal the cooler with strapping or duct tape and a custody seal.

- Samples for chemical analyses will be hand-couriered or shipped via overnight courier to the analytical laboratories once per day or whenever a cooler is filled, and accompanied by the COC record that identifies the shipment contents. The COC will be signed by the individual relinquishing samples to the onsite laboratory representative. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples will be recorded by the receiver. The field personnel will be responsible for the following:

- Packaging the samples.
- Signing the COC before placing inside the cooler to be sealed.
- Applying a shipping label, a custody seal, and strapping tape to the cooler.
- Shipping the samples in accordance with the maximum holding times allowed.
- Notifying the laboratory of when the samples are shipped.
- Confirm receipt of the samples by the laboratory in good condition.

All samples will be retained for a minimum of 6 months from the time they were received using standard laboratory handling procedures. They may be removed from the laboratory prior to the end of the 6-month period only at the direction of the SAIC project manager.

3.10 Chain-of-Custody Procedures

Samples will be retained at all times in the field crew's custody until samples are delivered or shipped to the appropriate laboratory by SAIC personnel. COC forms will be initiated at the time of sample collection to ensure that all collected samples are properly documented and traceable through storage, transport, and analysis. When all line items on the form are completed or when the samples are relinquished, the sample collection custodian will sign and date the form, list the time, and confirm the completeness of all descriptive information contained on the form. Each individual who subsequently assumes responsibility for the samples will sign and date the COC form. The field COC terminates when the laboratory receives the samples. The field sample custodian should retain a copy of the completed, signed COC form(s) for project files.

4.0 References

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Figure

Tables